

Magnetism of rare earth epitaxial films and rare earth based superlattices

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Rare earth based nanostructures are of particular interest because of the strong coupling between the crystal structure and the magnetic properties in these elements. For several years, our activity has been thus focused on the magnetic properties of these systems whose structure (the crystal structure as well as the stacking in the case of superlattices) can be carefully tailored using the technique of Molecular Beam Epitaxy. The magnetic investigation is mainly performed using magnetic diffraction (neutron scattering or Resonant X-ray Magnetic scattering) and X-ray Magnetic Circular Dichroism, the synchrotron based techniques being essential for the study of heterostructures combining several magnetic components.

The talk will be divided in three parts:

- (i) The first one is devoted to epitaxial rare earth films, where the epitaxial strains and the clamping effect to the substrate are shown to strongly modify the magnetic properties: for example the ferromagnetic transition temperature in Dy films and the direction of the magnetic propagation vectors in Eu films.
- (ii) The second part deals with the magnetic coherence phenomena in rare earth superlattices. The cases of heavy and light rare earth will be successively presented, the latter being of particular interest because of the coexistence of two atomic sites with different symmetries.
- (iii) Finally, the magnetization reversal process in exchange coupled superlattices combining a magnetically hard and a magnetically soft REFe_2 intermetallic will be presented. This study has especially enlightened a huge thermal evolution of the magnetization reversal in the superlattices with thin hard layers, and contributes to a better understanding of exchange spring and exchange bias phenomena.